Base (chemistry)

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(Redirected from Basic (chemistry))

The common (Arrhenius) definition of a **base** is a chemical compound that either donates hydroxide ions or absorbs hydrogen ions when dissolved in water. Bases and acids are referred to as opposites because the effect of an acid is to increase the hydronium ion concentration in water, whereas bases reduce this concentration. Arrhenius bases are water-soluble and always have a pH greater than 7 in solution.

There are other more generalized and advanced definitions of acids and bases.

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Common bases

- Baking soda (sodium hydrogen carbonate)
- Sodium carbonate
- Ammonia and amines
- Pyridine and other basic aromatic rings
- Metal hydroxides like sodium hydroxide or potassium hydroxide
- Many metal oxides form basic hydroxides with water (anhydrides)

Bases and pH

The pH of (impure) water is a measure of its acidity. In pure water, about one in ten million molecules dissociate into hydrogen ions (H^+) and hydroxide ions (OH^-), according to the equation

$$H_2O \leftrightarrow H^+ + OH^-.$$

The concentration (in mole/liter) of the ions is indicated as $[H^+]$ and $[OH^-]$; their product is the dissociation constant of water with and has the value 10^{-14} $mole^2/l^2$. The pH is defined as $-\log [H^+]$; thus, pure water has a pH of 7. (These numbers are correct at 23 °C and slightly different at other temperatures.)

A base accepts (removes) hydrogen ions (H^+) from the solution, or donates hydroxide ions (OH^-) to the solution. Both actions will lower the concentration of hydrogen ions, and thus raise pH. By contrast, an acid donates H^+ ions to the solution or accepts OH^-, thus lowering pH.

The pH of a solution can be calculated. For example, if 1 mole of sodium hydroxide (40 g) is dissolved in 1 liter of water, the concentration of hydroxide ions becomes $[OH^-] = 1$ mole/l. Therefore $[H^+] = 10^{-14}$ mol/l, and $pH = -\log 10^{-14} = 14$.

Neutralization of acids

When dissolved in water, sodium hydroxide decomposes into hydroxide and sodium ions:

$$NaOH \rightarrow Na^+ + OH^-$$

and similarly, hydrochloric acid forms hydronium and chloride ions:

$$HCl \rightarrow H^+ + Cl^-.$$

When the two solutions are mixed, the H^+ and OH^- ions combine to form water molecules:

$$H^+ + OH^- \rightarrow H_2O.$$

If equal amounts of NaOH and HCl (measured in moles, not grams) are dissolved, the base and the acid exactly neutralize, leaving only NaCl (table salt) in solution.

Alkalinity of non-hydroxides

Both sodium carbonate and ammonia are bases, although neither of these substances contains OH^- groups. That is because both compounds accept H^+ when dissolved in water:

$$Na_2CO_3 + H_2O \rightarrow 2Na^+ + HCO_3^- + OH^-$$
$$NH_3 + H_2O \rightarrow NH_4^+ + OH^-.$$

See also

- Acid-base reaction theories

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